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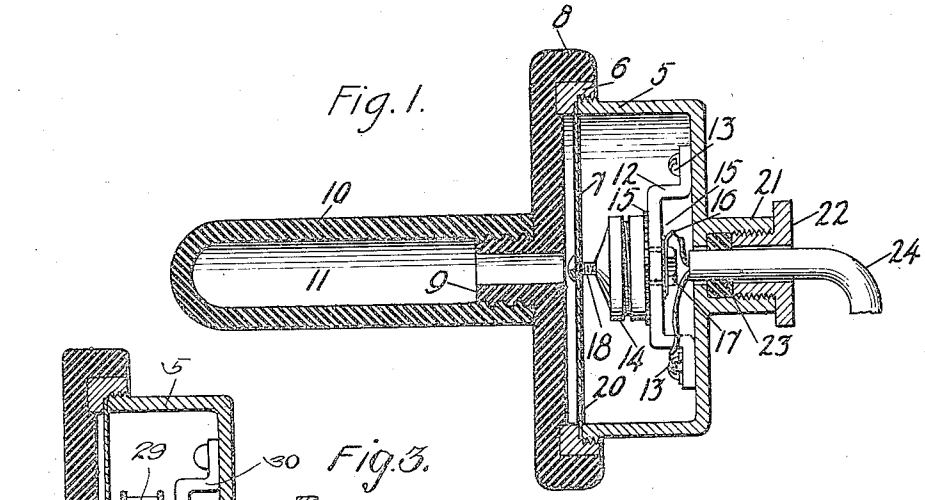
J. W. HORTON

SUBMARINE SIGNALING

Filed Oct. 31, 1919

Fig. 1.



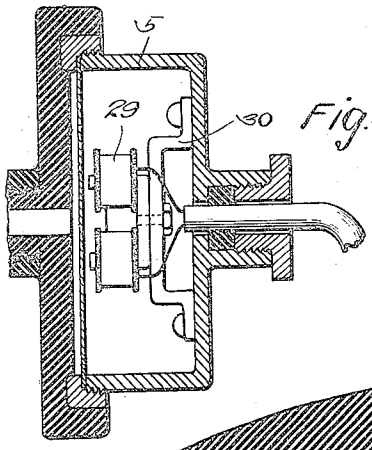
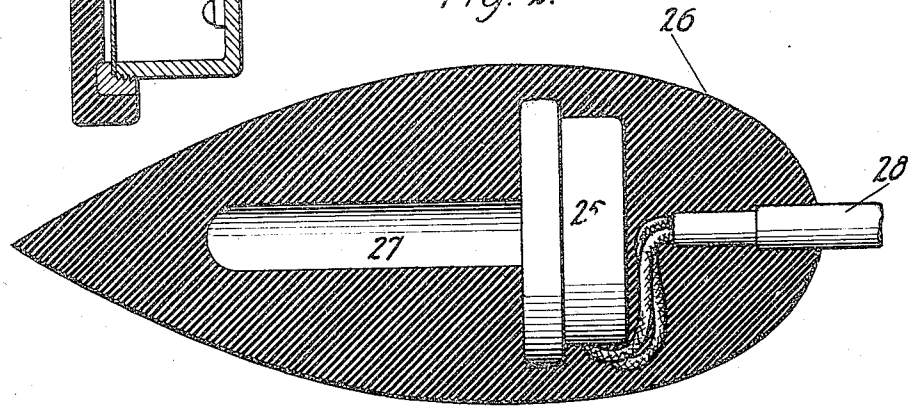


Fig. 3.

Fig. 2.



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UNITED STATES PATENT OFFICE.

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SUBMARINE SIGNALING.

Application filed October 31, 1919. Serial No. 334,684.

This invention relates to submarine signaling and particularly to a sound wave energy translating device for underwater use.

It is an object of the present invention to provide a device of high sensitivity which may be used for the detection of faint underwater vibrations and which may also be used as a generator for imparting vibrations to the water for signaling purposes.

A further object of the invention is to provide such an instrument in which means is provided for preventing a change in characteristics of the vibration responsive device due to hydrostatic pressure exerted when the device is submerged at varying depths.

A still further object of the invention is to provide a device in which the operating parts are completely protected from the surrounding water and one which may be drawn through the water with the minimum amount of disturbance due to the friction of the device with the water.

To accomplish these objects and in accordance with a feature of this invention, there is provided a sound responsive device enclosed in a water-tight chamber and having a vibrating diaphragm with a rigid chamber on one side and a collapsible chamber on the other side together with means for equalizing the pressure on each side of the diaphragm when the device is submerged under water and hydrostatic pressure is exerted on the collapsible air chamber.

In accordance with still another feature of the invention, there is provided a sound responsive device completely enclosed in a body of resilient energy absorbing material such as soft rubber, this body having a stream line shape in order that while being towed through the water it may cause the minimum amount of disturbance.

These and other features of the invention may be more clearly understood by reference to the accompanying drawing in which Fig. 1 is a view partly in section illustrating a device embodying the features of this invention, and Fig. 2 illustrates a modified form of the device shown in Fig. 1 in which the sound responsive element is completely enclosed in a body of rubber or similar material of stream line shape.

Referring now to the drawings, there is disclosed in Fig. 1 a cup-shaped casing 5, the outer perimeter of which is threaded to engage similar threads on a clamping ring 6 which securely clamps the diaphragm 7 to the casing. The clamping ring 6 is molded in or otherwise secured to the cap 8 of hard rubber or similar insulating material, the central portion of which is formed as shown to provide a hollow threaded nipple 9. A flexible tube 10 of soft rubber or similar material is forced over the threads of nipple 9 and, since the other end of this tube is closed, there is provided an air chamber 11 in front of the diaphragm 7. Within the casing 5 and at the rear there is provided a bridge member 12 secured to the casing by means of the screws 13—13 and carrying thereon a transmitter button 14. The stem portion of the transmitter button is insulated from the casing by means of the insulating washers 15—15 and connection thereto is made by means of the terminal 16 which is held in position by the nut 17 which threads directly on the transmitter button stem. The front electrode of the transmitter button is provided with a stem portion 18 which is rigidly secured to the center of the diaphragm 7. In order to equalize the pressure on either side of the diaphragm 7, the latter is provided at its outer edge with a small perforation 20. The casing 5 is provided at its rear with a hub portion 21 which is provided with interior threads to engage similar threads on a hollow nut 22. The end of this nut bears against a soft rubber ring 23 which is prevented from longitudinal movement by the construction of the casing 5. As the nut 22 is tightened, the ring 23 is compressed and provides a water-tight seal with the cable 24 comprising a pair of conductors, one of which is connected to the terminal 16 while the other is secured to the bridge member 12 which is in electrical connection with the front electrode of the transmitter button.

When the device is submerged, vibrations propagated through the water set in vibration the column of air in the chamber 11 which in turn causes corresponding vibrations in the diaphragm 7 and corresponding changes in the characteristics of the transmitter button 14. The tendency of the diaphragm to bow, due to hydrostatic pressure when the device is submerged, is entirely

overcome by means of the small perforation 20 which communicates with the air chamber on either side of the diaphragm.

In the device illustrated in Fig. 2, there is provided a casing 25 in which is mounted a sound responsive device such as a transmitter button or an electromagnetic unit and a vibrating diaphragm. This device is completely enclosed by means of a body of rubber 26 having a stream line shape. In front of the diaphragm or sound responsive body, there is provided an air chamber 27, which corresponds to the air chamber 11 of Fig. 1. In this case, no stuffing box arrangement is necessary, the cable 28 in which are carried the conductors being molded directly into the rubber body and serving as a means for towing the device through the water.

In the device illustrated in Fig. 3, there is shown an electromagnetic unit of the ordinary receiver type used in place of a transmitter button as a sound responsive element and which is adaptable for use as a source of underwater sound for signaling purposes. The electromagnetic unit 29 is mounted on the bridge 30 within the casing 5 in substantially the same manner as the transmitter button is mounted in Fig. 1. When the device is operated as a vibration responsive element, the diaphragm is caused to vibrate in the same manner as previously described when a transmitter button is used, the vibration of the diaphragm causing corresponding variations in the current flowing through the windings of the electromagnet. As a matter of fact, under certain conditions, the electromagnetic unit is preferable since it is not subject to any mechanical agitation and, although it is inherently less sensitive than a transmitter button, this feature can be overcome by the employment of suitable amplifying means. If an electromagnetic unit is used as the sound responsive element, the device may be operated very satisfactorily as a source of underwater sound for signaling purposes. By sending an alternating or pulsating current through the winding of the electromagnetic unit, the diaphragm is set in vibration causing similar changes in the collapsible air chamber which in turn impart corresponding vibrations to the surrounding water.

What is claimed is:

1. In a vibration responsive device, a diaphragm, means responsive to the vibration of the diaphragm to vary the electrical characteristics of a circuit, and a body of resilient energy-absorbing material completely enclosing said diaphragm and circuit-varying means.

2. In a vibration responsive device, a diaphragm, means responsive to the vibration of the diaphragm to vary the electrical characteristics of a circuit, and a body of resilient energy-absorbing material having a stream line shape completely enclosing said diaphragm and circuit varying means.

3. In a vibration responsive device, a circuit-varying means completely surrounded by a body of resilient energy-absorbing non-metallic material.

4. In a vibration responsive device, a circuit-varying means completely surrounded by a body of resilient energy-absorbing non-metallic material, said body having a stream line shape.

5. In a vibration responsive device, a circuit-varying means having a chamber and a vibrating diaphragm supported therein, and a body of resilient energy-absorbing material completely enclosing said circuit-varying means, said body being provided with a chamber communicating with the chamber immediately in front of said diaphragm.

6. In a vibration responsive device, a diaphragm, means on one side of the diaphragm responsive to the vibration of said diaphragm to vary the electrical characteristics of a circuit, a housing for said circuit-varying means, and means on the other side of the diaphragm for providing a collapsible air tight chamber, having walls of resilient energy absorbing material, said diaphragm serving as a closure for the collapsible chamber.

7. In a vibration responsive device, a diaphragm, a rigid chamber on one side of the diaphragm, a collapsible air tight chamber having walls of resilient energy absorbing material on the other side of the diaphragm and closed thereby, and means within said rigid chamber and responsive to the vibration of the diaphragm to vary the electrical characteristics of a circuit.

8. In a vibration responsive device, a diaphragm, a rigid chamber on one side of the diaphragm, a collapsible air tight chamber having walls of resilient energy absorbing material on the other side of the diaphragm, said chambers being interconnected for equalizing the pressure on either side of the diaphragm, and means within said rigid chamber responsive to the vibration of the diaphragm to vary the electrical characteristics of a circuit.

9. In a translating device for sound wave energy for under water use, a diaphragm, a collapsible air-tight chamber having walls of resilient energy absorbing material on one side of the diaphragm and closed thereby, and an electromagnetic sound translating device operatively associated with the other side of said diaphragm.

In witness whereof, I hereunto subscribe my name this 20th day of October, A. D., 1919.

JOSEPH W. HORTON.